

WE CLAIM:

1           1. A sputter-coated glass article comprised of a  
2 glass substrate having on a planar surface thereof, from  
3 the glass outwardly, a layer system including:

4               a) a layer comprised of  $\text{Si}_3\text{N}_4$  and stainless steel  
5 wherein said stainless steel is in an amount of about 0.5%-  
6 15% by weight of said layer;

7               b) a layer of nickel or nichrome;

8               c) a layer of silver;

9               d) a layer of nickel or nichrome; and

10              e) a layer comprised of  $\text{Si}_3\text{N}_4$  and stainless steel,  
11 wherein said stainless steel is in an amount of about 0.5%-  
12 15% by weight of said layer, and wherein

13              when said glass substrate has a thickness of  
14 about 2mm-6mm, said coated glass substrate has a normal  
15 emissivity ( $E_n$ ) of about 0.06 or less, a hemispherical  
16 emissivity ( $E_h$ ) of about 0.07 or less, a sheet resistance  
17 ( $R_s$ ) of about 5.0 ohms/sq. or less and having a substantially  
18 neutral visible reflected color when viewed from the glass  
19 side.

1           2. A sputter-coated glass article according to claim  
2 1 wherein said coated glass substrate has a visible  
3 transmittance of at least about 70%.

1           3. A sputter-coated glass article according to claim  
2   1 wherein said glass article is heat treatable.

1           4. A sputter-coated glass article according to claim  
2   1 wherein said layer system further includes an undercoat  
3   layer comprised of  $TiO_2$ , and the layers have about the  
4   following thicknesses:

5	<u>layer</u>	<u>thickness (Å)</u>
6	undercoat	100-400
7	a	20-120
8	b	7-50
9	c	75-225
10	d	7-30
11	e	50-600

1           5. A sputter-coated glass article according to claim  
2   4 wherein said glass substrate has a normal emissivity ( $E_n$ )  
3   of about 0.05 or less, a hemispherical emissivity ( $E_h$ ) of  
4   about 0.06 or less, a sheet resistance ( $R_s$ ) of about 5.0  
5   ohms/sq. or less.

1           6. A sputter-coated glass article according to claim  
2   5 consisting essentially of said undercoat layer and layers  
3   (a)-(e) and wherein said stainless steel in said layers (a)  
4   and (e) is in an amount of about 6% by wt. of said layer.

1           7. A sputter-coated glass article according to claim  
2   6 wherein the layers have about the following thicknesses:

3	<u>layer</u>	<u>thickness (Å)</u>
4	undercoat	200-250
5	a	40-60
6	b	7-30
7	c	150-180
8	d	7-15
9	e	400-500

1           8. A sputter-coated article according to claim 7  
2   wherein said layers (b) and (d) are comprised of chromium  
3   nitride, and said stainless steel is comprised of chromium  
4   nitride.

1           9. A sputter-coated article according to claim 8  
2   wherein the layers have about the following thicknesses:

3	<u>layer</u>	<u>thickness (Å)</u>
4	undercoat	225
5	a	50
6	b	20
7	c	165
8	d	7
9	e	450

10   and wherein the glass substrate having said layer system  
11   thereon has the following characteristics:

12                   GLASS SIDE

13                   R<sub>G</sub>Y is about 11.0  
14                   a<sub>h</sub> is about 2.3  
15                   b<sub>h</sub> is about -8.8

16

FILM SIDE

17

R<sub>f</sub>Y is about 6.0

18

a<sub>h</sub> is about 5.4

19

b<sub>h</sub> is about -17.5

20 wherein RY is the reflectance and a<sub>h</sub> and b<sub>h</sub> are the color  
 21 coordinates as measured in Hunter units, Ill. C, 10°  
 22 observer, and wherein said layer system is mechanically and  
 23 chemically durable and has a visible transmittance of about  
 24 76%.

1 10. A sputter-coated article according to claim 9  
 2 wherein said layer system is heat treatable.

1 11. A sputter-coated glass article according to claim  
 2 1 wherein said layer system consists essentially of said  
 3 layers (a)-(e) and said layers have about the following  
 4 thicknesses:

5	<u>layer</u>	<u>thickness (Å)</u>
6	a	200-600
7	b	7-50
8	c	115-190
9	d	7-30
10	e	50-600

1 12. A sputter-coated article according to claim 11  
 2 wherein the layers have about the following thicknesses:

3	<u>layer</u>	<u>thickness (Å)</u>
4	a	400-500
5	b	7-30
6	c	140-170
7	d	7-15
8	e	400-600

1        13. A sputter-coated article according to claim 12  
2 wherein said layer system is chemically and mechanically  
3 durable.

1        14. A sputter-coated article according to claim 13  
2 wherein said layers have about the following thicknesses:

3	<u>layer</u>	<u>thickness (Å)</u>
4	a	450
5	b	20
6	c	155
7	d	7
8	e	550

9 and wherein said glass substrate having said layer system  
10 thereon has a visible transmittance greater than about 70%.

1        15. A sputter-coated article according to claim 14  
2 wherein said glass substrate having said layer system  
3 thereon has the following characteristics:

4                    GLASS SIDE

5                     $R_g Y$  is about 10.2  
6                     $a_h$  is about 0.4  
7                     $b_h$  is about -4.7

8                    FILM SIDE

9                     $R_f Y$  is about 4.6  
10                     $a_h$  is about 6.5  
11                     $b_h$  is about -15.8

12 wherein  $R_Y$  is the reflectance and  $a_h$  and  $b_h$  are the color  
13 coordinates as measured in Hunter units, Ill. C, 10°  
14 observer.



13 wherein  $R_Y$  is the reflectance and  $a_h$  and  $b_h$  are the color  
14 coordinates as measured in Hunter units, Ill. C, 10°  
15 observer.

1 21. A sputter-coated article according to claim 20  
2 wherein the glass side and film side characteristics are:

3 GLASS SIDE

4  $R_Y$  is about 9 to 15  
5  $a_h$  is about -1 to +3  
6  $b_h$  is about -4 to -10

7 FILM SIDE

8  $R_f$  is about 4 to 10  
9  $a_h$  is about +3 to +7  
10  $b_h$  is about -10 to -20.

1 22. A sputter-coated article according to claim 1  
2 wherein said visible transmittance of said coated glass  
3 substrate is about 74%-76%.

1 23. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass wherein  
3 at least one sheet of glass is a sputter-coated sheet of  
4 glass according to claim 1.

1 24. An insulating glass unit according to claim 23  
2 wherein said two sheets of glass are sealed together at  
3 their peripheral edges thereby to define an insulating  
4 chamber therebetween, and wherein said layer system is

5 located on a surface of one of said glass sheets within  
6 said insulating chamber, and the reflectance and color  
7 characteristics when viewed from outside are:

8  $R_g Y$  about 14 to 20  
9  $a_h$  about -2 to +2  
10  $b_h$  about 0 to -10

11 and when viewed from the inside are:

12  $R_f Y$  about 11 to 18  
13  $a_h$  about 0 to +4  
14  $b_h$  is about 0 to -10

15 and the visible transmittance is at least about 61%.

1 25. An insulating glass unit according to claim 24  
2 wherein said unit is an insulating glass window, door or  
3 wall and the visible transmittance is at least about 63%.

1 26. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass sealed  
3 together at their peripheral edges thereby to define an  
4 insulating chamber therebetween, wherein at least one of  
5 said glass sheets is a sputter-coated sheet of glass  
6 according to claim 4 wherein said layer system is located  
7 within said insulating chamber.

1 27. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass and  
3 sealed together at their peripheral edges thereby to define  
4 an insulating chamber therebetween, wherein at least one of  
5 said glass sheets is a sputter-coated sheet of glass



6 according to claim 8 wherein said layer system is located  
7 within said insulating chamber.

1        28. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass heat  
3 sealed together at their peripheral edges and defining a  
4 substantially air-free insulating chamber therebetween,  
5 wherein at least one of said glass sheets is a sputter-  
6 coated sheet of glass according to claim 10, wherein said  
7 layer system is located within said insulating chamber.

1        29. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass sealed  
3 together at their peripheral edges thereby to define an  
4 insulating chamber therebetween, wherein at least one of  
5 said glass sheets is a sputter-coated sheet of glass  
6 according to claim 11 wherein said layer system is located  
7 within said insulating chamber.

1        30. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass and  
3 sealed together at their peripheral edges thereby to define  
4 an insulating chamber therebetween, wherein at least one of  
5 said glass sheets is a sputter-coated sheet of glass  
6 according to claim 13 wherein said layer system is located  
7 within said insulating chamber.

1           31. An insulating glass unit comprised of at least  
2 two substantially parallel, spaced sheets of glass heat  
3 sealed together at their peripheral edges and defining a  
4 substantially air-free insulating chamber therebetween,  
5 wherein at least one of said glass sheets is a sputter-  
6 coated sheet of glass according to claim 18, wherein said  
7 layer system is located within said insulating chamber.

1           32. In a method of making an insulating glass unit  
2 comprised of at least two sheets of glass sealed at their  
3 peripheral edges to each other thereby to define at least  
4 one insulating chamber therebetween, said method including  
5 the steps of spacing said glass sheets apart, said sheets  
6 at an elevated temperature, and sealing the peripheral  
7 edges of said sheets to each other at or above said  
8 elevated temperature, the improvement comprising using as  
9 at least one of said glass sheets, said sputter-coated  
10 glass article of claim 3, so located that said layer system  
11 thereon is within said insulating chamber.

1           33. In the method of claim 32 wherein at least one of  
2 said glass sheets is the sputter-coated glass article  
3 according to claim 10.

1           34. In the method of claim 32 wherein at least one of  
2 said glass sheets is the sputter-coated glass article  
3 according to claim 16.